Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

NEW INSTANCES OF COMPLETE DIVISION OF THE MALAR BONE, WITH NOTES ON INCOMPLETE DIVISION.

ALEŠ HRDLIČKA.

THE malar bone in man, and also among lower mammals, is found occasionally to present a partial or a complete division.

The complete malar divisions are in general rare; the incomplete ones are rare in most of the species of the lower mammals, but are quite common in man. Both varieties of the divisions occur with unequal frequency in the different races of man, and, seemingly, even in different localities in the same people.

The first case of a complete malar division in man was described in 1779 by Ed. Sandifort.[1] Since then the anomaly has been observed among most of the principal branches of the whites and also among the Japanese, Aïnos, Chinese, Buriats, Bashkirs, Burmans, natives of the Malay Archipelago and of the Philippine Islands. The most important contributions to the literature of the subject are those by Breschet,[2] Wenzel Gruber,[3] and Virchow[4]; other authors who occupied themselves with malar divisions are Amadei,[5] Flesch,[6] Riccardi,[7]

---

[1] *Observat. Anat. Pathol.* Lugd., Batav., 1779. Vol. iii, 8, p. 113. Cit. Gruber.

[2] Recherches sur différentes pièces osseuses du squelette de l'homme et des animaux vertébrés, *Ann. d. Sci. Natur.*, Sér. 3, tome i, p. 25. Paris, 1844.

[3] Monographie über das zweigetheilte Jochbein, etc., Wien, 1873; five additional publications on the subject in *Arch. f. Anat. u. Phys.*, 1873, p. 208; 1875, p. 194; 1876, p. 230; and in *Arch. f. pathol. Anat. u. Phys.*, 1877, Bd. lxix, p. 382; and 1879, Bd. lxxvii, p. 113.

[4] Über die ethnologische Bedeutung des os malare bipartitum, *Monatsberichte d. k. preuss. Akad. d. Wiss.* Berlin, 1882, p. 230.

[5] *Arch. p. l' antropol. e l' etnolog.*, 1877, p. 11.

[6] Über das zweigetheilte Jochbein, *Verhandl. d. phys.-med. Ges. in Würzburg*, 1877, pp. 51, 52.

[7] Suture anomale dell' osso malare, *Arch. p. l' antropol. e l' etnolog.*, tomo viii (1878), pp. 1 *et seq.*

Hilgendorf,[8] Tarenetzkij,[9] Calori,[10] Matiegka,[11] etc. In other mammals cases of complete malar division have thus far been found in two *Cercopitheci sabæi* (Laurillard,[12] Breschet[2]); in four *Mycetes seniculi* (Laurillard, Breschet); in one *Mycetes niger* (Breschet); in an orang (Flesch[6]); in a hippopotamus (Breschet); and in a *Phascolomys wombatus* (Gruber[3]).

The complete malar divisions present some variety. In a very large majority of the cases, both in man and the lower mammals, the malar was found divided into two portions by a suture running antero-posteriorly from the malo-maxillary to the zygomatic articulation. In the orang described by Flesch the posterior extremity of the anomalous division terminated on the temporal border of the malar bone, a short distance anterior to the upper end of the zygomatic suture. In two of Calori's cases the posterior termination of the anomalous suture was situated respectively at the base and above the middle of the ascending portion of the temporal border. The second of these cases shows much similarity with one I have at hand, in which the malar division is due to fracture (*v.* the end of this paper).

Testut reports a case[13] in which the division ran in a curve from the ascending portion of the orbital border to the middle of the malo-maxillary suture. Spix,[14] Breschet,[2] Riccardi,[7] and Ruggeri,[15] finally, observed a division of the malar into three portions, the location of which differed in each instance.

Of incomplete malar divisions there have been described thus far only horizontal ones in which the suture connects with either the zygomatic or the malo-maxillary suture.

---

[8] *Arch. f. patholog. Anat. und Phys.*, Bd. lxx (1879), pp. 113 *et seq.*

[9] Beiträge zur Craniologie der Aïnos und Sachalin, *Mém. de l'Acad. Imp. Sci. de St. Pétersbourg*, Sér. 7, tome xxxvii (1890), p. 39.

[10] Su le anomalie dell' osso zigomatico, etc., *Mem. d. R. Accad. d. Sci. dell' Istit. d. Bologna*, Ser. 5, tomo iii (1893), p. 415.

[11] Prvni Lebka z Čech s "Os Malare Bipartitum," *Věstnik Král. České Společ. Náuk*, vol. xxviii, pp. 1–24. Prague, 1899. Also in German.

[12] In Cuvier's *Leç. d'Anat. Comparée*, 2d ed., tome ii (Paris, 1837), pp. 385, 386. Cit. Gruber.

[13] *Traité d'Anatomie Humaine*, tome i, p. 174. Paris, 1889.

[14] *Cephalogenesis s. capitis ossei structura, formatio et significatio* (Monachi, 1815), p. 13. Cit. Gruber.

[15] Un osso zigomatico tripartito, *Rivista Sperim. di Treniatria*, tomo xxiii (1897), p. 460; refer. *Centralbl. f. Anthropol.*, Bd. iii (1898), p. 20. Cit. Matiegka.

The presence of a malar division is generally held to signify a non-fusion of the original centers from which the bone developed. It is not yet definitely settled whether there are usually two or three of these centers. According to Breschet the malar bone develops in the majority of cases from one, in a smaller number of instances from two, and occasionally from three centers of ossification. Gruber was of a similar opinion. Rambauld and Renault, on the other hand, advanced the theory that the malar develops always from three points of ossification. In the words of these authors (*Origine et dévelopment des os* (Paris, 1864), pp. 161, 162, Atlas, Pl. XIII, Figs. 4, 5), "nous l'avons (l'os malaire) toujours vu s'ossifier par un seul centre, mais composé de trois points." "Ces points . . . apparaissent de très bonne heure et se réunissent très-vite." "Vers le milieu, et plus souvent à la fin du second mois, l'os malaire est composé de trois points." The subject is much in need of further embryological investigation.

Nothing is known as to the immediate causes of the anomaly and but little as to its signification.

The meaning and importance of the incomplete divisions will be considered later.

NEW TESTAMENT OF COMPLETE MALAR DIVISION.

The new cases of complete malar division which came under my observation comprise one instance of the anomaly in a white adult woman, one in an adult male Peruvian (prehistoric), a bilateral division in an orang and in a Lagothrix, and a unilateral one in a Cercopithecus, a Mycetes, and a bear. In detail, these cases are as follows:

Case I (Fig. 1). — The first specimen consists of a part of the face, including the right malar, of a white adult female, found by me among the unidentified bones in Professor Huntington's osteological collection in the College of Physicians and Surgeons (Medical Department, Columbia University), New York City.

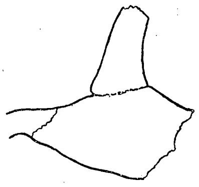

FIG. 1

The malar bone shows remnants of an anomalous division, which separated the frontal process from the body of the bone.

The division runs in the line of the posterior or horizontal position of the temporal border of the malar and consists of a row of small, irregular perforations, with a larger, round foramen in the middle. It is plain, on both the anterior and posterior surfaces of the bone, that the line of openings is the remnant of a former complete separation of the frontal process.

There are no signs of injury. The part of the face with the left malar has not been recovered. The right malar shows no further abnormality.

The malar division in this specimen is analogous with the superior of the two divisions in the case described by Riccardi, and is considered by Matiegka, whom I informed of the case, to represent a non-union of the superior of three centers from which the bone developed.

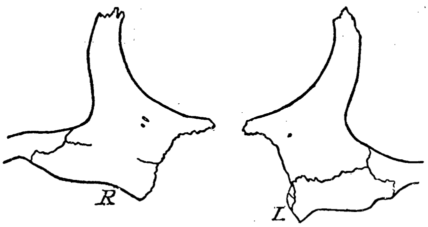

FIG. 2.

Case 2 (Fig. 2). *Malar Division in a Peruvian.* — This is the first instance of a complete malar division found among aboriginal Americans. It is the only skull with a complete division that I found among 492 old-Peruvian and over 2000 other Indian crania from various localities. The specimen is one of the Bandelier collection, in the American Museum of Natural History, New York City.

The skull is that of a male of between forty and fifty years of age. It is of a moderate size, and shows nothing extraordinary except a moderate artificial frontal compression and a persistence of the metopic suture.

The left malar presents a complete and patent, horizontal, serrated suture, which divides it into a narrow lower, and large upper, portion. The right malar shows in a similar location a 0.5 cm. long, straight, anterior, and a 0.7 cm. long, slightly serrated, posterior, incisure.

The two malars differ considerably in size, the left one being higher, but narrower, than the right one.

	LEFT.	RIGHT.
Highest point of fronto-malar suture vertically downward to the anomalous suture,	4.2 cm.	——
Highest point of fronto-malar suture vertically downward to lower edge of the malar,	5.2 cm.	4.4 cm.
A line between the most superior point of the malo-maxillary and the zygomatic suture,	3.7 cm.	3.9 cm.
A line between the most inferior point of the malo-maxillary and the zygomatic suture,	2.7 cm.	3.2 cm.

This excess in height and deficiency in breadth of the fully divided malar when compared to its mate is in full accordance with previous observations on this point. A relative narrowness of the inferior of the two portions of the divided malar is also more the rule than the exception.

The incisures in the right malar have apparently influenced the growth of that bone but little. The evidence of the measurements is against their equivalence with the complete division on the right. If these incisures are remnants of a complete division, the measurements indicate an early union of the middle portion of the malar.

The presence of the frontal division has apparently no relation to that in the malar bone. A persistent metopic suture is present in 97 of the 492 Peruvians, without there being another case of a complete malar division; there is also in these skulls no excess of malar incisures.

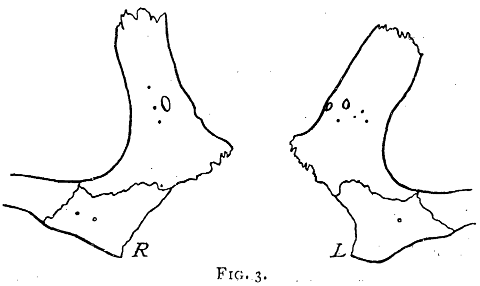

FIG. 3.

Case 3 (Fig. 3). *A Bilateral Complete Malar Division in an Orang.* — The skull is that of a young orang and is a part of a mounted skeleton in Professor Huntington's museum in the College of Physicians and Surgeons, New York City. Besides the malar divisions the specimen shows nothing unusual.

The malar sutures are in every way much alike on the two sides. They run each with a moderate double curve from near the middle of the malo-maxillary to very near the superior termination of the zygomatic suture. Both divisions are slightly serrated.

The right malar bone is slightly higher than the left one, but the frontal process and to a less extent the body of this latter is broader.

The situation of the malar sutures in this case is similar to that in the orang described by Flesch; the posterior termination of the division in Flesch's case lay, however, still somewhat higher, terminating on the temporal border of the malar, slightly anterior to the zygomatic suture.

Case 4 (Fig. 4). *A Unilateral Complete Malar Division in a Cercopithecus callitrichus.* — Among the forty skulls of Cercopitheci in the zoölogical collection of the American Museum of Natural History, New York City, there is one with a complete and one with a partial malar division.

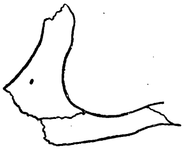

FIG. 4.

The skull with the complete division belongs to an adult female, *C. callitrichus* (No. 13,923), and shows besides the malar also a bilateral parietal division.

The malar division is found on the left only; there is no trace of a similar anomaly on the right side.

The malar suture begins anteriorly at a point between the lower and middle thirds of the malo-maxillary articulation, runs backward parallel with the inferior border of the malar, and terminates in the curve of the temporal border of the bone, 0.8 cm. anteriorly to the upper end of the zygomatic suture.

The divided malar is in whole higher than the undivided one (l. 2.9 cm., r. 2.4 cm.), and its frontal process is broader; but the bodies of the two bones are of very nearly the same dimensions.

The lower separate portion is relatively narrow.

Neither in this nor in any of the preceding cases is there an extension of any process of bone from the zygoma to the maxillary.

The case of a partial malar division in a Cercopithecus (Fig. 5) may be conveniently described in this connection. The skull showing this anomaly is that of an adult animal of unknown sex and variety. It is free from other abnormalities. The division occurs in the right malar bone. It begins distally in the deepest portion of the curve of the temporal border of the bone, is somewhat curved, well serrated, and extends forward to the middle of the body of the bone. It is equally pronounced on the anterior and posterior surface of the malar. The divided bone is externally very slightly higher than the other malar, and its body is slightly narrower.

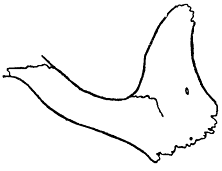

Fig. 5.

Case 5 (Fig. 6). — The skull of an adolescent male *Lagothrix humboldti* (specimen No. 6333, American Museum of Natural History, New York) shows a bilateral, antero-posterior, complete malar division. Anteriorly the division begins on each side slightly below the middle third of the maxillary border of the bone and from this point runs horizontally backward, to terminate on the temporal border of the malar. The posterior termination of the division reaches to within one millimeter of the superior portion of the zygomatic suture on the left and to within two and a half millimeters of the same on the right side. Both the anomalous sutures are serrated. They show both much better dorsally than ventrally. In this specimen there is on each side but a slightly incomplete temporo-maxillary arc. The large malar foramina (regular in these monkeys) are situated well above the divisions. The two malars are very nearly of equal size, except anteriorly, where the right bone is slightly higher.

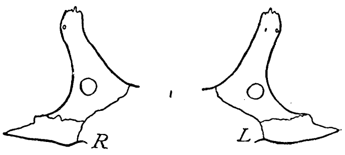

Fig. 6.

The skull shows no other anomalies, nor anything pathological. In three other skulls of monkeys of the same variety the malars are normal.

Case 6 (Fig. 7). — Among twelve skulls of Mycetes, in the American Museum of Natural History, there is one (No. 14,169) which shows a complete unilateral malar division.

The skull with a complete division is one of an adolescent male *M. alouata*, and is otherwise in every respect normal.

The division affects the left malar. It begins anteriorly slightly above the lower third of the maxillary border of the bone and runs, with some serration, backward, very nearly parallel with the inferior border of the malar, to the zygomatic suture near its superior termination. Ventrally the division is covered by a broad temporo-maxillary arc.

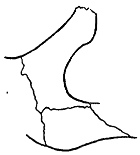
FIG. 7.

The right malar is normal. It is both lower and narrower than the left bone, and even the zygomatic arch is lower on the right.

MEASURES.

	LEFT.	RIGHT.
Height along the maxillary border,	2.0 cm.	1.85 cm.
Width at middle (width minimum),	0.6 cm.	0.55 cm.
Height of temporal process vertically, from the superior end of the zygomatic suture,	0.8 cm.	0.65 cm.

In a skull of Mycetes, in the same collection, there is in each temporal border of the malar, slightly anterior to the zygomatic suture, a short incisure, directed forward.

Besides those already mentioned I have examined, for malar divisions, the skulls of 6 Lemurs, 5 Nictipitheci, 31 Cebi, 10 Ateles, 1 *Silenus vetur*, 16 Cercocebi, 1 Senmopithecus, 54 Macaques, 4 Mormons, 1 Innuus, 2 Cynopitheci, and 16 Cynocephali, — all in the collection in the American Museum of Natural History. Among these specimens there is none with complete and only a few with incomplete malar divisions. Of these latter only the following one deserves to be mentioned in this place.

Cynocephalus olivaceus (No. 10,747; Fig. 8). — The left malar shows a faint and only dorsally visible, incomplete, serrated suture, running from a point a very little above the lower third of the maxillary border of the bone to the malar foramen. The length of the suture is 1.1 cm. The right malar shows traces of a similar division. The two malars are almost exactly equal.

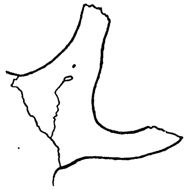
FIG. 8.

This case differs from any thus far on record. The exact nature of the division is uncertain.

Case 7, Unilateral Malar Division in a Bear. (No. 4282, American Museum of Natural History; Fig. 9). — The division affects the left malar of a young American black bear (incisors and canines not yet replaced by teeth of the second dentition).

Dorsally only the superior third of the division is open, the other portion of it being secluded but still traceable; ventrally the anomalous suture is patent in its entirety.

The division begins anteriorly considerably below the middle of the malo-maxillary articulation and runs in almost a straight direction upward and slightly backward, to the base of the frontal process. The suture shows a slight serration.

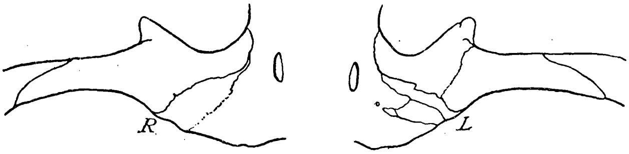

Fig. 9.

The frontal process of both the malars is partly detached. The right malar shows a small anterior incisure in a location corresponding to the antero-inferior terminus of the division on the left. Finally, there are on the left one small bone and two larger, oblong ones, and on the right one large, oblong osside, intercalated between the antero-inferior two-thirds of the malar and the superior maxilla.[16]

The two malars show but little difference in size.

The above specimen is one of twenty young adolescent and young adult skulls of bears of the same variety preserved in the American Museum of Natural History. No other of these skulls presents a complete malar division similar to that in No. 4282; several of the specimens, however, show an anterior malar incisure, visible on the internal surface of the bone. Besides this almost all the specimens present more or less of a separation of the frontal process of the malar. In four of the skulls the separation of the process is complete, in two bilaterally and in one on one side. The following figure shows one of these instances; in this case there is not only a complete separation of the frontal process, but also a superior incisure, running in a similar direction to the anomalous suture in the young bear (No. 4282; Fig. 10).

---

[16] A similar bone has been found in man by Gruber (*Arch. f. Anat., Physiol.*, etc. (1873), p. 195, Pl. V, Fig. 1). See also Breschet.

Separations of the frontal process, such as the one just pictured, have been observed in the seal and walrus (Meckel, Pander, d'Alton, Hallman, Köstlin, cit. Gruber; the condition is present in a number of young seals in the collection in the American Museum of Natural History); they remind one of the superior division of the malar in Riccardi's case and the one similarly situated in the first case reported in this paper.

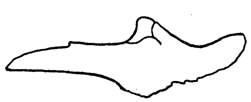

FIG. 10.

The division of the body of the malar bone is, as shown in the bear (No. 4282), independent of the separation of the frontal process. This latter appears in the bears as an epiphysis of a comparatively late formation.

It is interesting to note that the posterior termination of the malar suture, situated somewhat higher in the orangs, is placed still higher, relatively, in most of the specimens in lower monkeys and other mammals. This condition is very marked in the Cercopithecus and especially in the young bear. The cause of this lies, it seems to me, not so much in a different situation of the centers from which the malar develops, as in the different tilting of the bone, and in the differences in the temporal process, in man and the mentioned animals. The human malar bone is less tilted than that in bears, and its temporal process is considerably shorter and relatively broader than that of apes, monkeys, and bears, as well as other mammals.

PARTIAL MALAR DIVISION.

The anterior and particularly the posterior portion of the malar shows occasionally a partial division. These divisions occur mostly in the form of lineal incisures, but occasionally also as serrated sutures. They differ much in length, in some cases not exceeding one or two millimeters, in others extending to near the middle of the malar. In man they run as a rule in an antero-posterior direction, beginning distally from either the zygomatic or the malo-maxillary suture.

The posterior divisions are in the average more pronounced and much more frequent than the anterior ones. An anterior and a posterior partial division may coexist in the same bone, and there is a tendency, though there are exceptions, to similar divisions on the two malars.

There is a considerable difference in the frequency of these partial malar divisions in different peoples. They are found in the adults of both sexes, but grow more rare as age advances; they are, according to my data, somewhat more frequent in early than in adult life.

These malar incisures are well known, but their meaning is still somewhat doubtful. Gruber, who was the first to give these divisions close attention, considered them as morphologically distinct from the complete separations. In the words of this author (*Virch. Arch.*, Bd. LVII, 1879, p. 117), "*os zygomaticum bipartitum* is a term applied only to that malar bone which is fully divided into two portions and persists thus divided after the second month of the fœtal life, as well as after birth; or to that malar, which was originally fully divided, but in which the anomalous suture became later (in adult life), in consequence of synostosis, more or less occluded." "When [*ibid.*] in a fœtal malar bone, through a hindrance in development (Bildungshemmung), the streaks between the orbital and maxillo-zygomatic portion of the bone do not on one or both sides ossify, and this defect of ossification persists, in the form of an incisure, into advanced age, leaving thus a sort of a *sutura mendosa*, in that case one evidently cannot speak of a divided malar."

This apparently clear and rational theory was three years later opposed by Virchow.[1] This author expresses himself (p. 251) as "inclined to recognize the majority of all malar incisures, particularly the posterior ones, as real remnants of an old transverse malar suture"; but (p. 252) "the interpretation of a posterior incisure will be the more doubtful, the higher the situation of the incisure."

Both Gruber's and Virchow's opinions gained adherents, and in the absence of decisive embryological investigation the matter is still unsettled.

The significance of the partial malar divisions can be actually demonstrated only by studies on the embryo. Nevertheless, the examination of older subjects brings out a few points from which, it seems to me, it is possible to draw a few deductions having a bearing on the nature of these divisions.

Such points are the size of the incisures, their somewhat greater frequency in childhood than in adult life, and the lack of correspondence in frequency between the incomplete and complete divisions in childhood in general or in the adults of different ethnic groups.

All the points mentioned speak *against an exact equivalence* of the partial and complete malar divisions and for Gruber's theory. Were all or a majority of the incisures remnants of formerly complete separations of the malar, it is reasonable to suppose that we should, even if rarely, meet with a remnant of the separation that would extend over more than a half of the bone; and it would be logical to expect a greater frequency of complete divisions in early than in later life and in those tribes or races in whom the incisures are more common than in others. As these conditions *are not realized* we must search for another explanation for the incisures. This explanation can be found, as already pointed out by Gruber, in the analogies of the development of the malar with other cranial bones, particularly the occipital, or the parietal.

The parietal bone will, I think, serve the demonstration even better than the occipital. The bone develops, as was shown by Toldt and Ranke, from two superimposed centers of ossification, — a very similar process to that which undoubtedly takes place in the body of the malar, though this bone may possibly develop from more than two original points. The two centers of the parietal have but a very brief separate existence. They grow in all directions and very soon coalesce. Their union takes place at their reciprocally most advanced portions, in the middle, the parts anterior and posterior to this point of fusion remaining separated by a more or less V-shaped space or fissure.

This fissure, as the bone grows, gradually closes at its proximal extremity, but becomes extended, by the new bone, at its distal end. The result of this is that even as late as at the birth of the human fœtus the parietal bone shows a more or less marked posterior, and rarely also an anterior, partial division, exactly analogous with, it seems to me, though almost generally less persistent than, the malar incisures. The parietal division may persist even up to adult life and then the analogy between the same and a malar incisure is still closer. The difference between this form and a complete division (or a remnant of such) in either the parietal or the malar is that in the simple incisure and fissure we have before us only a *retardation* of the union of the distal portions of the original segments of the bone, while in the complete division (or its remnant) we are confronted with a case of a complete non-union and *separate development* of these segments. The two effects may be produced, and probably are produced in such a case as that in the Peruvian skull with a complete malar division on one and two incomplete ones on the other side, by different degrees of the same cause; nevertheless they cannot be considered identical. The cause which induces a separate development of all or some of the centers of ossification of a bone must be potent and be present extremely early; a persistence of a fissure might be due to a weaker cause of the same nature, but possibly also to later causes of differing kind. The complete divisions deserve fully the term "anomalies," or "atypical formations," while the partial divisions come more under the category of developmental defects or retardations.

The partial malar divisions are not attended by similar conditions in other bones of the skull. They also do not seem to stand in any relation with the metopic division; specimens with the frontal suture in my Peruvian series have, upon an additional inspection, shown no greater percentage of malar incisures than other skulls in the same collection.

There is nothing in the appearance of the partial divisions, except, perhaps, their size, which would allow us to differentiate them from *remnants* of complete malar sutures. Should a division extending beyond the middle of the bone be found, it would then be safe, I think, to consider it a remnant of a partly occluded complete suture. Tarenetzkij[17] would distinguish the incisures from remnants of complete divisions by the greater height of the malar in which a complete division had existed than that of its mate, but such a criterium, though theoretically seemingly correct, meets in practice with numerous difficulties. Not many malars, even though entirely free from divisions, are exactly equal. The presence of partial divisions, especially when large, is probably not without influence on the size of the bone. Where a complete suture had existed but became early subject to partial obliteration, the size of the malar was undoubtedly less affected than in the cases where the suture remained patent until more advanced life. Finally, where a bilateral complete division existed, if obliteration on the two sides proceeded simultaneously, the malars would be liable to be of a very nearly equal size, and the indications of a complete suture would be absent; or, had the occlusion proceeded with much difference in time, the two malars would be unequal, and we should be predisposed to consider only the incisures in the larger malar as the remnants of a complete suture.

Actual measurements bear out well the uncertainty of basing any conclusions upon the difference in the size of the malars. Taking at random one hundred skulls of Peruvians of both sexes, in whom both malars were well preserved and the malar articulations were free from any signs of occlusion, I measured the dimension of the malar mostly affected by a transverse division, namely, the height of the body of the bone. The measurements were taken with a sliding compass at the middle of the bone, parallel with the malo-maxillary suture. Among the one hundred skulls there were seventy-two in which the malars showed no division, sixteen in which both malars showed a posterior incisure,[18] four in which the right, and seven in which the left, malar presented a posterior incisure, and one in which both malars showed both posterior and anterior incisures. The results of the measurements, which hardly need any comment, will be found in the table on the opposite page.

---

[17] Tarenetzkij. *Mém. de l'Acad. Imp. de Sci. de St. Pétersbourg*, tome xxxvii, No. 13 (1890), p. 39.

[18] Only lineal incisures above 1 mm. in length considered.

	Equal.	Larger by 0.5 mm.		Larger by 1 mm.		Larger by 1.5 mm.		Larger by 2 mm.		Larger by 2.5 mm.		Larger by 3 mm.	
		Left.	*Right.*	*Left.*	*Right.*	*Left.*	*Right.*	*Left.*	*Right.*	*Left.*	*Right.*	*Left.*	*Right.*
1) Malars with no division	29	6	5	10	9	5	2	1	1	0	2	2	0
2) Both malars with a posterior incisure .	3	3	1	0	3	3	0	2	0	1	0	0	0
3) Right malar with a posterior incisure .	1	0	0	1	0	0	0	0	0	1	1	0	0
4) Left malar with a posterior incisure .	3	0	2	1	0	0	0	0	1	0	0	0	0
5) Both malars with an anterior and a posterior incisure	0	1	0	0	0	0	0	0	0	0	0	0	0

RÉSUMÉ:

	Equal.	Left Malar Higher.	Right Malar Higher.
1)	29	24	19
2)	3	9	4
3)	1	2	1
4)	3	1	3
5)	0	1	0

The incomplete malar divisions occur in whites, according to various authors,[19] with the following frequency:

Gruber found the posterior incisure among 4000–5000 mainly Russian skulls in 428, or 8.5 to 10.7% and among 50 skulls of children and embryos in 7, or 14%.
Meyer found the incisures among 517 German skulls in 20, or 3.9%; among 42 Russian skulls in 3, or 7.1%.
Tarenetzkij found the incisures among 45 French skulls in 2, or 4.4%; among 416 Russian skulls in 28, or 6.7%.
Anutschin (source and kind of incisures not stated) in 1.2%.[20]
Matiegha found among 300 Czech skulls the posterior incisures in 22, or 7.3%; in anterior incisures in 6, or 2.0% of the cases.

All the authors who examined various ethnic crania for the partial malar divisions (Meyer, Sarasin, Tarenetzkij, Anutschin, Koganei, etc.) found them to be more frequent in almost all other peoples (Australians excepted, Anutschin) than in the whites.

In the human skulls that I have examined for this condition the partial malar divisions were distributed as shown in the tables on pages 290 and 291.[21]

The data given on these pages show plainly:

1. A considerably greater frequency of partial malar divisions in the American aborigines than in the whites. This excess in the partial is not associated with any corresponding excess in the complete divisions.

2. The divisions among the American aborigines occur relatively more frequently in the females than in the males and most frequently in children; however, the differences in the percentages in these three groups are not excessive.

3. The posterior divisions greatly preponderate in frequency over the anterior ones.

4. Both the anterior and posterior incisures are much more frequently bilateral than unilateral.

---

[19] In part after Matieghka.

[20] Has unusually low percentages with all the groups examined — apparently some individual peculiarity in recording.

[21] Only plainly marked incisures above one millimeter in length counted. All skulls in which there were signs of synostosis in the malar articulations were excluded. The material examined belongs to the collections of the American Museum of Natural History and the College of Physicians and Surgeons, New York City.

No malar incisures were found in the Australians and Polynesians. Among the various American tribes, the largest proportions of the incisures were found among the Peruvians and the Southern Utah Cliff Dwellers, but in general the data on the Americans, or at least those on the better represented tribes, show a considerable agreement.

In mammals below man malar incisures appear to be very rare. However, I found some instances of the condition in monkeys and a bear. The cases in monkeys, besides those mentioned, are as follows:

Cynocephalus porcarius (No. 10,277, *A. M. N. H.*). — The left malar shows dorsally a marked anterior incisure, beginning in the maxillary border of the bone a short distance above the antero-inferior angle and directed obliquely upward and backward.

The skull of a young Cynocephalus (No. 135, *C. P.* and *S.*) shows on each side an anterior malar incisure somewhat similar in location and direction, but smaller, particularly on the right, to that in the preceding case.

In a *Cercocebus mona* (No. 5025, *A. M. N. H.*) a 0.5 cm. long, horizontal incisure divides slightly above its middle the temporal process of the left malar.

The subject of partial malar divisions could be finished here were it not for two other forms of incisure which are met with on the bone.

The first of these incisures, already mentioned, is the one which occurs at the base of the frontal process of the malar in some animals. It is common in younger American bears; it is also occasionally found in seals and other pinnipeds, but is rarely seen in other classes of mammals. This division is a remnant of a complete separation of the frontal process of the malar; no analogous incisure has been found thus far in man, apes, or monkeys.

The second special form of partial malar division seems to occur only in man. It consists of a more or less marked, vertical, or more often somewhat oblique, frequently bilateral incisure, which runs downward from some part of the malo-frontal suture. So far as I can find, this incisure has not yet

NO. OF SKULLS.		SEX.	ANTERIOR INCISURES.			POSTERIOR INCISURES.			NO INCISURES.
			Right only.	*Left only.*	*On Both Sides.*	*Right only.*	*Left only.*	*On Both Sides.*	
72	Whites	M.	—	—	—	4, or 5.6%	3, or 4.2%	6, or 8.3%	59, or 81.9%
50	"	F.	—	—	—	1, or 2%	—	2, or 4 %	47, or 94%
5	"	Children	—	—	—	1, or 20%	—	—	4, or 80%
10	African Negroes	M.	—	—	—	—	—	1, or 10%	9, or 90%
6	" "	F.	—	—	—	1, or 16.7%	—	—	5, or 83.3%
9	Australians and Polynesians. .	M.	—	—	—	—	—	—	9, or 100%
11	" " " . .	F.	—	—	—	—	—	—	11, or 100%
	Americans:								
4	Esquimaux.	M.	—	—	—	—	—	1, or 25%	3, or 75%
2	"	F.	—	—	—	—	—	1	1
2	"	Children	—	—	—	—	—	—	2
17	Northwest Coast Indians . . .	M.	—	—	—	—	—	3, or 17.6%	14, or 82.4%
9	" " " . . .	F.	—	—	1, or 11.1%	2, or 22.2%	—	—	6, or 66.7%
11	Eastern and Middle States Indians	M.	—	—	—	—	—	—	11, or 100%
4	" " " " "	F.	—	—	1, or 25%	—	1, or 25%	—	2, or 50%
1	" " " " "	Children	—	—	—	—	—	—	1
	Southwest:								
40	Southern Utah Cliff Dwellers .	M.	—	—	1, or 2.5%	—	6, or 15%	10, or 25%	23, or 57.5%
7	" " " " .	F.	—	—	—	1, or 14.3%	—	—	6, or 85.7%
7	" " " " .	Children	—	—	—	—	—	4, or 57.1%	3, or 42.9%
17	Pueblos	M.	—	—	—	—	1, or 5.9%	3, or 17.6%	13, or 76.5%
4	"	F.	—	—	1	—	—	—	3, or 75%
6	"	Children	—	—	1, or 16.7%	—	—	1, or 16.7%	4, or 66.7%

	Mexico:								
15	Tarahumares	M.	—	—	—	1, or 6.7%	—	1, or 6.7%	13, or 86.7%
17	"	F.	1, or 5.9%	—	1 also post., or 5.9%	—	—	1, or 5.9%	14, or 82.4%
5	"	Children	—	—	—	—	—	1, or 20%	4, or 80%
62	Tarascos	M.	—	—	1, or 1.6%	2, or 3.2%	2, or 3.2%	3, or 4.8%	54, or 87.1%
18	"	F.	1, or 5.6%	—	—	1, or 5.6%	—	4, or 22.2%	12, or 66.7%
4	"	Children	—	—	—	—	—	3, or 75.0%	1, or 25%
63	Various parts of Mexico . . .	M.	—	—	—	1, or 1.6%	4, or 6.3%	7, or 11.1%	51, or 80.9%
29	" " " " . . .	F.	1, or 3.4%	—	—	1, or 3.4%	2, or 6.9%	5, or 17.2%	20, or 69%
4	" " " " . . .	Children	—	—	—	1, or 25%	—	1, or 25%	2, or 50%
70	Peruvians (1st Series)	M.	—	—	—	2, or 2.9%	7, or 10%	16, or 22.9%	45, or 64.3%
30	" " "	F.	—	—	—	4, or 13.3%	—	8, or 26.6%	18, or 60%
82	Peruvians (2d Series)	M.	1, or 1.2%	—	1, or 1.2%	4, or 4.9%	6, or 7.3%	14, or 17.1%	55, or 67.1%
20	" " "	F.	—	—	—	—	3, or 15%	3, or 15%	14, or 70%
12	" " "	Children	—	—	—	—	1, or 8.3%	3, or 25%	8, or 66.7%
92	Peruvians (3d Series)	M.	—	—	1, or 1.1%	3, or 3.2%	6, or 63%	15, or 16.3%	67, or 72.8%
8	" " "	F.	—	—	—	1, or 12.5%	1, or 12.5%	1, or 12.5%	5, or 62.5%

TOTALS OF AMERICAN ABORIGINES.	ANTERIOR INCISURES.			POSTERIOR INCISURES.			NO INCISURES.
	Right only.	*Left only.*	*On Both Sides.*	*Right only.*	*Left only.*	*On Both Sides.*	
473 Males	1, or 0.2%	—	4, or 0.8%	13, or 2.7%	32, or 6.8%	73, or 15.4%	350, or 74%
148 Females	3, or 2%	—	4, or 2.7%	10, or 6.8%	7, or 4.7%	23, or 15.5%	101, or 68.2%
41 Children	—	—	1, or 2.4%	1, or 2.4%	1, or 2.4%	13, or 31.7%	25, or 61%

been described. I have met with it in the skulls of whites as well as in those of Indians. It is a rare condition, much more rare in the Indians than the divisions in the posterior portion of the malar. Thus far I have found no specimen which would offer an explanation of the significance of this superior incisure. Occasionally, as in the specimen illustrated in the accompanying figure, it is in a curving line with several malar foramina.

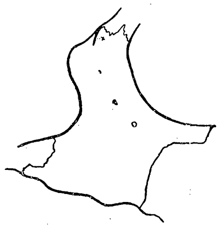

FIG. 11.

In my examination for malar divisions I came across three specimens which may prove of interest in connection with this paper.

In looking over the few bear skulls in the collection in the College of Physicians and Surgeons (New York), I found one with a peculiar anomaly present on both sides. Both malar bones in this specimen show a partial separation of the frontal process, but no other division. There is, however, on each side a complete separation, by a previous, well-serrated suture, of that portion of the zygomatic process of the temporal bone which covers the temporal process of the malar (Fig. 12).

The two other specimens are human malars (Nos. 1068 and 1069, College of Physicians and Surgeons, New York), one of which shows the marks of a complete, the other those of an incomplete, vertical fracture. Both of these malars present a pronounced depression over their temporal portion. Some force was undoubtedly applied to this point, and the malar bone was fractured over and along the line of the internal malo-maxillary articulation. The border of the maxillary articular surface acted as a fulcrum over which the bone broke. There is no callus formation, and both cases bear some resemblance to a malar suture (Figs. 13 and 14).

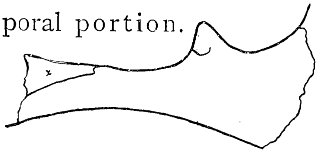

FIG. 12.

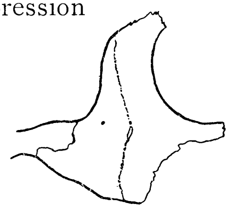

FIG. 13.

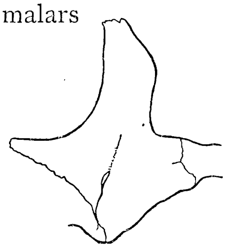

FIG. 14.

In connection with the search for malar incisures in Indians two other points were noted, namely, the lineal, antero-posterior groove on the ventral surface of the malar (Gruber) and the temporo-maxillary arc. The groove was found to be almost constant, while the arc is generally more or less incomplete.

NOTE.

While my paper on malar divisions has been in the hands of the printer, the American Museum of Natural History has received two skulls of adult African lions, one of which shows a partial malar suture.

The suture is in the left malar; the right malar has been fractured (post-mortem), and its posterior half is wanting. Dorsally, the separation runs sagittally from a point slightly posterior to the angle of the temporal border of the malar and a somewhat greater distance anterior to the zygomatic suture, over more than half of the malar, after which it bends downward and terminates; the division is somewhat serrated and contains five small Wormian ossicles. Ventrally, the malar suture runs in a serrated manner a short distance forward and unites with the boundary of a large Wormian bone, the anterior extremity of which reaches to a point slightly posterior to the dorsal termination of the suture.

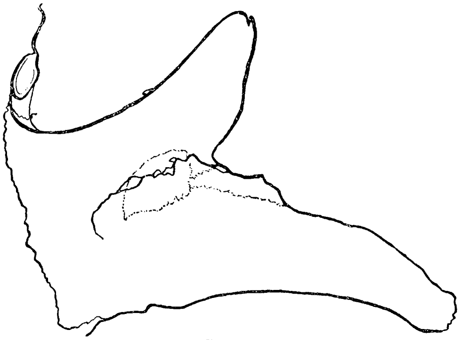

Fig. 15.

The malar shows no signs of any recent or old injury, and the division is undoubtedly congenital. It is probably a remnant of a complete malar suture, the anterior extremity of which became subject to an early synostosis. The curving anterior end can be explained by a simultaneous excess in growth of the anterior portion of the superior, and the posterior portion of the inferior, part of the malar.

The frontal process of the bone shows in its summit a vertical incisure.

There are eighteen other lion skulls of various ages in the Museum, but in none of these is there any indication of a sagittal malar division.